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METHOD OF FINISHING AN IMAGE FORMED FROM TONER PARTICLES

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(19) (CA) # CANADIAN PATENT

(54) METHOD OF FINISHING AN IMAGE FORMED FROM TONER PARTICLES

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A METHOD OF FINISHING AN IMAGE FORMED FROM TONER PARTICLES

ABSTRACT OF THE DISCLOSURE

Finishing an image formed from toner particles by applying a transparent resinous layer over the image, and incorporating light dispersing powder particles in said resinous layer to produce an overall matte finish.

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a method of finishing an image formed from toner particles, wherein said image is given an overall matte finish. More particularly, the present invention is directed to an image having an overall matte finish which is obtained by the application of a resinous layer containing light dispersing powder particles to said image.

An image obtained by an electrophotographic method is generally composed of powdered toner particles, and because said particles produce a scattering of light, the image frequently possesses an overall pale appearance unless an appropriate type of surface treatment is utilized. This result is particularly noticeable in images obtained by a liquid development processes, and can be attributed to the fact that the toner particles of the liquid developer are primarily composed of light scattering pigments. Appropriate surface treatment of an image formed from toner particles and obtained by an electrophotographic process should not only fix the toner particles to the substrate, but also should effectively suppresses the surface reflection in the toner image areas, thereby increasing the image density and significantly improving the image quality. However, surface treatment of the toner image with a transparent lacquer often produces a overall glossy surface which makes the image disturbing or unpleasant to observe. On the other hand, prior attempts to apply an overall matte finish to an electrophotographic image have been found to produce inferior effects and undesirable

results when compared to finishing methods using a transparent lacquer. This is due to the fact that the surface reflections of the toner particles are not sufficiently suppressed.

According to the present invention, a method is provided for finishing an image obtained, for example, by means of an electrophotographic process, and formed from toner particles, with an overall matte appearance. Broadly, in the practice of this invention, toner particles are deposited on the surface of a substrate in an image-wise configuration, a transparent resinous layer is applied over said surface, and light dispersing powder particles are incorporated in said resinous layer, thereby giving said image an overall matte finish. The light dispersing powder particles can be incorporated in the resinous layer by applying said particles directly to the transparent resinous layer, or by applying said particles suspended in a second resinous solution over the surface of the first resinous layer. In the case where the light dispersing powder particles are applied directly to the transparent resinous layer, the resinous layer is advantageously softened by heat or solvent to fix said particles in said layer, or said particles can be applied before the resinous layer has solidified.

The present invention provides an improved method for finishing images formed from toner particles, which fixes the toner image, suppresses the surface reflections from the toner particles of the image, and simultaneously achieves a overall

matte finish. The present invention is applicable to monochromic or multi-color images, and particularly to such images obtained by liquid development processes.

This invention will become more apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given hereinbelow in conjunction with the accompanying drawings, which are given by way of

illustration only and thus are not limitative of the present invention, and wherein:

Figure 1 shows the formation of an image formed from toner particles on the surface of an electrophotographic sensitive sheet;

Figure 2 shows the application of a transparent resinous layer on the image surface shown in Figure 1;

Figure 3 shows the incorporation of light dispersing powder particles in the transparent resinous layer, said particles being applied while suspended in a resinous solution; and

Figures 4 and 5 show the incorporation of light dispersing powder particles in the transparent resinous layer by direct application of said particles to the resinous layer.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings wherein the same reference numberals are used throughout the various figures to designate identical or corresponding elements, Figure 1 shows a toner image 12 formed from toner particles deposited on the surface of a substrate 11. The substrate 11 may be an electrophotographic sheet, and the toner image 12 may have been formed thereon by means of a conventional electrostatic photographic process. The toner image can be obtained by various development methods, such as for example, liquid development, powder cloud development, cascade development, magnetic brush development, and the like. Also, the substrate 11 could be a transfer sheet to which the

toner image has been applied from an electrophotographic element, such as a selenium plate.

In Figure 2 a resinous solution 13 is applied over the substrate containing the toner image to form a transparent resinous overlay 14 thereon. The resinous solution can be applied to said image substrate by means of spraying or dipping. Alternatively, said overlay can be formed by laminating a transparent pressure-sensitive or heat sensitive film over the image surface. This step of the process not only fixes the toner image but also suppresses light reflections from the surface of the toner particles constituting the toner image, thereby increasing the image density and improving the image quality.

Figure 3 shows the incorporation of light dispersing powder particles in the overlay by forming a matte layer 16 on top of the resinous layer 14. Thus, an overall matte finish can be obtained by spraying a liquid consisting of a resinous solution 15 containing fine, light dispersing particles 17 with a low refractive index dispersed therein onto the surface of the resinous layer 14. The light dispersing particles 17 may be selected from various pigments, such as for example, aluminum hydroxide, silica gel, calcium carbonate and the like, and preferably have an average particle size of less than about 0.1 micron. The refractive index of the fine particles 17 contained in the matte layer 16 is desirably as low as possible. Advantageously, the refractive index should approximate that of the resinous vehicle, which usually has a low refractive

index. When the refractive index of the fine particles 17 exceeds about 1.8, and particularly when it exceeds about 2.0, the transparency of the matte layer 16 may tend to be decreased. Accordingly, it is preferred that the refractive index be less than about 2.0. However, if the size of particles 17 is less than the wavelength of visible light, such as in the case of silica gel (amorphous silicon dioxide), it is not significant if the refractive index is greater than the stated upper limit of about 2.0. The matte layer 16 can be formed by various coating methods such as by manual brushing, spraying, dipping and the like.

Figures 4 and 5 show another method for forming the matte layer of the present invention. In Figure 4, pigment powder 21, such as described above, is distributed over the surface of the resinous layer 14 by means of electrostatic scattering, electrophoresis, or the like. Said surface is then uniformly heated, e.g. by an infrared lamp as shown in Figure 5, thereby softening the resinous layer 14 to fix the light idspersing powder particles 21 in the layer 14 and provide the desired matte finish. Alternatively, the distributed powder particles 21 can be fixed in resinous layer 14 by spraying the surface with a solvent for the resinous layer, or by treating the surface with the vapor of said solvent. Furthermore, a matte finish can also be formed by scattering the powder 21 on the resinous layer 14 while said layer is still in the wet or plastic state, and thereafter drying or setting said resinous layer. In order to prevent fading or coloration of the image on photosensitive layer

11 during prolonged storage, an ultraviolet light-absorbing agent is advantageously added to the resinous layer 14 and/or the matte layer 16. Various compounds belonging to the benzotriazole family can be used as ultraviolet absorbing agents. Also, the adhesion of dust during storage can be prevented by adding a small amount of antistatic agent to the matte layer. Although the resinous layer 14 and matte layer 16 can be provided by direct coating using manual or mechanical methods, it is preferred to use an aerosol spray containing the resinous solution or matte solution and pressurized with Freon*, methyl chloride or propane gas. For the application of resinous and matte layers on a large scale, a spraying method using a spray gun and pressurized air is particularly suitable.

In the foregoing discussion it should be apparent that the finishing method of the present invention effectively fixes the toner image, and suppresses reflections from the surface of the toner powder particles, thereby substantially improving the image quality and increasing the image density. In addition, this method provides a uniform overall matte finish for the image surface.

The following specific examples are given to further illustrate the present invention and are not to be considered as limiting. Unless otherwise noted, the quantities hereinafter recited are parts by weight.

EXAMPLE I

An electrostatic latent image formed on the surface of an electrophotographic zinc oxide photosensitive layer is developed

* trade mark

with a liquid developer having as a composition: 1 part by weight of carbon black, 5 parts by weight of an alkyd resin modified with safflower oil (oil length 65%), and 1000 parts by weight of kerosene. The liquid developer is prepared by kneading carbon black and the alkyd resin with a small amount of the kerosene, and then diluting the mixture with the remainder of the kerosene. The surface of the photosensitive layer containing the developed black image thereon is dried and a transparent lacquer having the following composition is sprayed onto the entire surface of said layer with an aerosol spray:

Polybutyl methacrylate (average molecular weight 12000)	85 parts
Ethyl acetate	56 parts
Butyl acetate	20 parts
Toluene	15 parts
Xylene	9 parts

After the transparent lacquer layer is dried, a matte coating is formed by spraying the following composition onto the surface of the transparent lacquer layer from a spray can utilizing pressurized air:

Polybutyl methacrylate (average molecular weight 12000)	80 parts
Methylene chloride	300 parts
Toluene	220 parts
Tynubin* 326 (ultraviolet light absorbing agent of benzotriazole derivatives supplied by Geigy Chemical Corp.)	3 parts
Colloidal silica (average particle size 0.03 microns)	10 parts

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*trademark

An image with an overall matte finish is obtained by completely drying the photosensitive sheet. The image was sufficiently fixed to the substrate, and lightening of the image due to reflections from the toner particle surfaces could not be observed.

EXAMPLE II

This Example is the same as Example I, except that in the liquid developer 1 part of carbon black is replaced by 1 part of phthalocyanine blue. A blue image with an overall matte finish is obtained.

EXAMPLE III

This Example is the same as Example I, except that in the liquid developer 1 part of carbon black is replaced with one part of red pigment brilliant carmine 6B. A red image with an overall matte finish is obtained.

EXAMPLE IV

This Example is the same as Example I, except that in the matte coating composition 4 parts of colloidal silica are replaced with 4 parts of aluminum hydroxide having an average particle size of about 0.05 microns. The results obtained are substantially the same as in Example I.

EXAMPLE V

An electrostatic latent image formed on the surface of an electrophotographic zinc oxide photosensitive layer is

developed with a liquid developer having the same composition as the developer described in Example 1. The surface of the photosensitive layer containing the developed black image thereon is dried and a transparent lacquer having the same composition as the lacquer described in Example 1 is sprayed onto the entire surface of said layer with an aerosol spray.

Colloidal silica is then scattered uniformly over the entire surface thereof while the transparent lacquer is still in the wet and plastic state. Excessive silica is removed by blowing the surface with air. Upon drying, the finish thus obtained is found to be similar to that obtained in Example 1, except the surface is somewhat more coarse than that obtained in Example 1.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all modification that are embraced by the following claims are considered to be within the purview of the present invention.

WHAT IS CLAIMED IS:

1. A method of finishing an image formed from toner particles, comprising depositing toner particles on the surface of a substrate in imagewise configuration, applying a transparent resinous layer over said surface and deposited toner particles, and incorporating light dispersing powder particles in said resinous layer, whereby said image is given an overall matte finish.

2. A method as set forth in claim 1, wherein said light dispersing powder particles have an index of refraction of less than about 2.

3. A method as set forth in claim 1, wherein said light dispersing powder particles have an average particle size of less than about 0.1 micron.

4. A method as set forth in claim 1, wherein said transparent layer comprises a first portion fixing said toner particles to said surface, and a second portion having said light dispersing powder particles dispersed therein.

5. A method as set forth in claim 4, wherein said light dispersing powder particles have an index of refraction of less than about 2.

6. A method as set forth in claim 4, wherein said light dispersing powder particles have an average particle size of less than about 0.1 micron.

7. A method as set forth in claim 1, wherein said

transparent layer fixes said toner particles to said surface, said light dispersing powder particles are distributed over the surface of said transparent layer, and said light dispersing particles are then dispersed into the body of said transparent layer.

8. A method as set forth in claim 7, wherein said light dispersing powder particles have an index of refraction of less than about 2.

9. A method as set forth in claim 7, wherein said light dispersing particles have an average particle size of less than about 0.1 micron.

10. A method as set forth in claim 1 wherein the light dispersing powder particles are incorporated in the resinous layer in the form of a resinous solution ~~have~~ having said powder particles dispersed therein.

11. A matte finished image comprising an imagewise distribution of toner particles over the surface of a substrate, a transparent resinous fixing layer overlying said surface and the toner particles thereon, and light dispersing powder particles dispersed in said layer.

12. A matte finished image as set forth in claim 11 wherein said transparent resinous layer comprises a first portion

fixing said toner particles to said surface and a second portion having said light dispersing powder particles dispersed therein.

13. A matte finished image as set forth in claim 10 or claim 12, wherein said light dispersing powder particles have an index of refraction of less than about 2.

14. A matte finished image as set forth in claim 10 or claim 12, wherein said light dispersing powder particles have an average particle size of less than about 0.1 micron.

FIG. 1

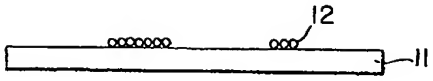


FIG. 2

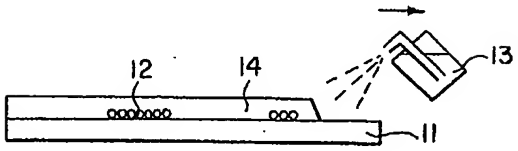


FIG. 3

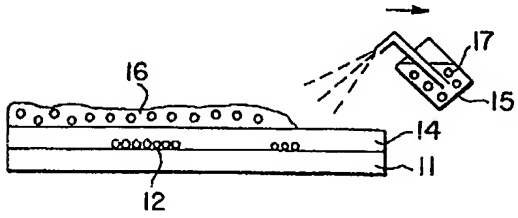


FIG. 4

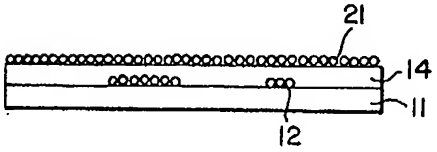
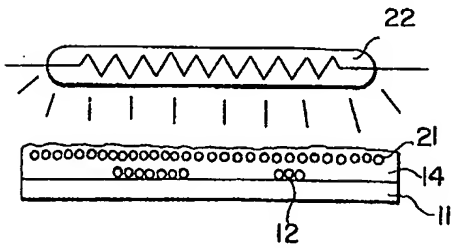


FIG. 5



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